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# Giovan Battista Della Porta and Francis Bacon on the creative power of experimentation

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## SPECIAL ISSUE

The Creative Power of Experimentation: Bacon and Della Porta

## GUEST EDITORS

Doina-Cristina Rusu and Dana Jalobeanu

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## Abstract

This special issue brings to the attention of the scholarly community some of the common features and some of the subtle, but important, differences between Francis Bacon's and Giovan Battista Della Porta's ways of dealing with the reading, selecting, enacting, and recording of recipes. Focusing on questions of genre, intellectual and material context, strategies of research, and strategies of performing recipes, the four papers of this special issue address two major issues. First, they shed new light on the relationship between Della Porta's *Magia naturalis* and Francis Bacon's *Sylva sylvarum*. Second, they show that in the recording of their experimental practices, Bacon and Della Porta depart from the traditional "recipe format" and discover new avenues of experimental research.

## KEYWORDS

experimentation, Francis Bacon, Giovan Battista Della Porta, natural magic

## 1 | INTRODUCTION

In his posthumous *Sylva sylvarum*, Francis Bacon wrote "this writing of our *Sylva sylvarum*, is (to speak properly) not natural history, but a high kind of natural magic."<sup>1</sup> This claim can be interpreted in various ways, but scholars generally took it to be a reference to Giovan Battista Della Porta's 16th-century bestseller, the *Magia naturalis*. As already

<sup>1</sup>Bacon (SEH 2, p. 278). This paper uses the standard abbreviations for citing Bacon's works. SEH, followed by volume and page number, refers to *The Works of Francis Bacon*, edited by J. Spedding, R. L. Ellis, & D. D. Heath (Bacon, 1859–1864).

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shown by the Victorian editor of Bacon's *Sylva sylvarum*, Robert Leslie Ellis, Della Porta's book constituted an important source of recipes and "experiments" for the composition of Bacon's collection.<sup>2</sup> In recent decades, a significant body of evidence has been added to substantiate this initial claim.<sup>3</sup> Research on this subject can be subsumed under three categories. First, some scholars looked into ways in which the second edition of the *Magia naturalis* constituted a source of recipes and experiments for Francis Bacon's *Sylva sylvarum*, showing either that experiments in the *Sylva* "are developed from those in Della Porta" or that the recipes and experiments of the *Magia naturalis* constituted "a basis upon which Bacon built his science of metaphysics and natural magic."<sup>4</sup> Second, other scholars discussed similarities in terms of genre. They saw both books as belonging to the same genre, that is, collections of recipes or what have been sometimes called "books of secrets."<sup>5</sup> Third, one can detect a similarity of purpose and style between these two works. Or, at a minimum, one can see that they both represent interesting avenues to a new way of speaking about knowledge—a new way of knowledge production through observations, experiments, and various attempts to try, test, and correct received practical knowledge.<sup>6</sup> Bacon and Della Porta seem to share a sort of epistemic optimism, a belief in the possibility of correcting, amending, and improving with respect to one's predecessors.

Despite all this recent and less recent work on particular similarities of content, genre, general purpose, and research methodology between Bacon and Della Porta, a thorough comparative investigation of the two works still remains to be undertaken. Our purpose in this special issue is to set the stage and to establish some directions of research that aim to clarify the terms of such a comparative inquiry. Our main premise in this project was that, in order to understand the substantial similarities and the important differences between Bacon and Della Porta, one has to go beyond the question of "borrowings." One has to ask questions of genre, intellectual and material context, and strategies of research, reading, and writing. Although diverse in terms of conceptual structure and the application of different methodologies, the four papers of this special issue share a common point: they all claim that the best framework to read and compare Bacon and Della Porta is what has recently been called "the recipe format."<sup>7</sup> And they all show—each in its own way—that both Bacon and Della Porta eventually depart from the recipe format, that they use this format of recording experimental practices in a creative and imaginative way to open up new avenues in their investigation of nature.

The papers in this special issue do not constitute a comprehensive comparative investigation of Bacon and Della Porta. They are merely forerunners to such an enterprise. With this project, we want to undertake the preliminary steps that would make such a comprehensive comparative investigation possible. We also argue that such an investigation is necessary, and that only through a deeper and more accurate understanding of the substantial similarities between the two works in question can we begin to grasp the subtle and fundamental differences that place them in different intellectual universes.

A comparative investigation of the *Sylva sylvarum* and the *Magia naturalis* is also likely to increase our knowledge about each of these works, which do not unveil their secrets easily. There are a number of quite interesting contingent similarities between these two writings: they were both extremely popular in the 16th and 17th centuries, only to be almost completely forgotten in the past 200 years. Neither of them has a modern scholarly edition in English, French, Italian, or German, despite the general agreement in the scholarly community that such an edition is very

<sup>2</sup>However, in his introductory study to the *Sylva sylvarum*, Ellis (1859, p. 326) claims that Bacon merely transcribed Della Porta's experiments. It is interesting that his verdict went uncontested for long time. It was even taken for granted by Graham Rees in his paper "Bacon's *Sylva sylvarum*: Prelude to Remarks on the Influence of the *Magia naturalis*," where, following Ellis, Rees states that Bacon simply borrowed and transcribed from Della Porta and that "some of the materials drawn from Della Porta's work may only have been introduced into the text as a make-weight" to reach the desired 1,000 experiments: Rees (1986, p. 271).

<sup>3</sup>Rees (1981; 1986); Serjeantson (2002); Rusu (2013; 2017); Jalobeanu (2016a).

<sup>4</sup>Serjeantson (2002, p. 88); Rusu (2017, p. 1).

<sup>5</sup>Klein (2008); Eamon (2011; 2017); Pastorino (2013). It is worth noting here that although both Della Porta's *Magia naturalis* and Francis Bacon's *Sylva sylvarum* have been discussed in the framework of the "recipe format" and books of secrets, these discussions never attempted a comparison between the two works. The articles in this special issue are the first attempt that treat the two works, comparatively, as belonging to (and departing from) the "recipe format."

<sup>6</sup>See the articles by Cesare Pastorino (2020) and Arianna Borrelli (2020) in this special issue. See also Orsi (2005); Saito (2014); Cypess (2016).

<sup>7</sup>The recipe format is discussed by Borrelli (2020) and Pastorino (2020); also, to some extent, by Dana Jalobeanu (2020). Recent literature on the recipe format includes Eamon (2011; 2020); Smith (2011); Leong & Rankin (2016); Hendriksen (in press); Leong (2018).

much needed.<sup>8</sup> Furthermore, both are subject of intense scholarly debate. To date, there is no widespread agreement regarding their genres, intended audiences, and European diffusion.

## 2 | TWO PROJECTS FOR THE REFORMATION OF NATURAL MAGIC

Magic occupies an important place in Francis Bacon's scheme for the reformation of knowledge. It fills the place of an applied metaphysics, as a practical science of forms that allows the investigator of nature to bring *novae* into the world.<sup>9</sup> But, like many other Baconian projects, the project of a new science of magic was never fully worked out. We barely have some of its preliminary steps.

At the end of his survey of received arts and sciences on a grand scale, *De augmentis scientiarum*, Bacon appended a list of the “deficients”—gaps, or sciences to be developed by subsequent generations of investigators of nature. One of these “deficients” is entitled *Magia naturalis, Or the Setting of Forms on Work*.<sup>10</sup> This was, presumably, Bacon's projected magic; a science he never developed but planned to do so. The question is: in what way one can read the *Sylva sylvarum* as belonging to this plan? And in what way is this plan related—if at all—to Della Porta's *Magia naturalis*?

It is useful to begin by looking at the larger picture. After all, Bacon's project of reforming magic to make it a respectable science was neither new nor revolutionary. One can rather see it as one of the last projects in a long tradition. In the 17th century, magic gradually became associated with witchcraft and demonology.<sup>11</sup> However, in the previous century, things had been different: magic was seen as a higher form of wisdom; and there was sometimes an interesting superposition between natural magic and natural philosophy. Projects for reviving natural magic abounded in the late 15th century and throughout the 16th century. Marsilio Ficino, Pico della Mirandola, Cornelius Agrippa, Giordano Bruno, Thommaso Campanella, and John Dee were just a handful of philosophers who aimed at reviving the true wisdom of the Persian Magi and who defended a natural magic founded on the knowledge of hidden (as opposed to manifest) powers of nature.

This is the tradition to which Della Porta's *Magia naturalis* belongs, but it is also the tradition Della Porta set out to reform. In 1558, when he was probably only 23 years old, Giovan Battista Della Porta published in Napoli his book entitled *Magia naturalis sive De miraculis rerum naturalium libri IIII* (*Natural Magic or the Miracles of the Natural Things in Four Books*). This book, which became a bestseller almost immediately, was a collection of recipes of very different sorts and on very different topics: from agriculture (*oeconomica*) to alchemy, from natural history to medicine, and from mechanics to optics. Many of these recipes were gathered from ancient sources, and quite a large number of them are explicitly attributed to a wide range of philosophers and naturalists, ranging from Aristotle, Theophrastus, Pliny, and Archimedes to Varro, Collumela, and Palladius, passing through Paracelsus and Albert the Great. What is typical for Della Porta, however, is that in the same breath he quotes and criticizes, refers to the authority of the ancients and emphasizes that he has “tried” and corrected their recipes and that therefore the kind of knowledge he provides is better or more accurate than that of the ancients.<sup>12</sup> The four books of the *Magia naturalis* do not have a very clear structure. The first book gives the reader an overview of the more theoretical aspects of magic. It talks about elements, virtues, qualities, sympathy and antipathy, and the simples or the mixtures. The other three books are collections of recipes and—sometimes—of experiments. Book 2 begins with recipes featuring flowers and fruits, but continues with recipes involving fire, cosmetics, and the production of sleep. Book 3 is a collection of medical recipes (including some alchemical ones), while Book 4 begins with optical experiments and continues with recipes involving the powers and virtues of stars and stones.

<sup>8</sup>There is a modern scholarly Romanian edition: Bacon (2017).

<sup>9</sup>Rossi (1968); Weeks (2007); Rusu (2013).

<sup>10</sup>Bacon (1640, p. 480). For a detailed discussion of Bacon's lists of desiderata and their reception, see Keller (2018).

<sup>11</sup>On the decline of magic during the 17th century, see especially Henry (2008).

<sup>12</sup>For a discussion, see Jalobeanu (2016a); Rusu (2017).

In 1589, Della Porta published a second edition of the *Magia naturalis*, so much enlarged that it looks like a new book.<sup>13</sup> Indeed, although the work included many (but by no means all) of the recipes from the first edition, a lot was added to it, on all sorts of new topics. This time we do not face the work of a young magician, but a sort of compendium of old and new knowledge, a compendium which incorporates much of Della Porta's decades of experimental investigation.<sup>14</sup> The work is substantially reorganized from the first edition. In fact, although it is still a collection of recipes, the second edition of the *Magia naturalis* carries traces of an attempt to organize knowledge in a sort of "encyclopaedia" of arts and sciences.<sup>15</sup> The volume is organized in 20 books, each focusing on a particular topic. The first four books deal with classes of things (animals, plants, stones, and metals), while the rest explicitly tackle the practical aspects of various arts and sciences (medicine, metallurgy, the art of distillations, magnetism, optics, statics, the art of writing and cryptography, and many more). The books begin with short, theoretical introductions, which sometimes set the principles under which the recipes and experiments are subsumed.<sup>16</sup> Often, these theoretical introductions also set forth methodological principles, such as:

These things which here you shall find, I my self have seen, and proved by experience, and therefore I am the bolder to set them abroad to the view of the whole world.<sup>17</sup>

The second edition of the *Magia naturalis* ends with a book entitled "The Chaos," a title reminiscent of neo-Platonism, but also of earlier *Sylvae*.<sup>18</sup> Della Porta's "Chaos" is a miscellanea very similar with Francis Bacon's *Sylva sylvarum*. It is perhaps not unexpected that Bacon's collection begins precisely where Della Porta ends, with experiments selected from "The Chaos." This is the short preface that Della Porta appends to his book on Chaos:

I determined at the beginning of my Book to write Experiments, that are contain'd in all Natural Sciences, but by my business that called me off, my mind was hindred, so that I could not accomplish what I intended. Since therefore I could not do what I would, I must be willing to do what I can. Therefore I shut up in this Book, those Experiments that could be included in no Classes, which were so diverse and various, that they could not make up a Science, or a Book; and thereupon I have here heaped them altogether confusedly at what I had overpassed; and if God please, I will another time give you a more perfect Book. Now you must rest content with these.<sup>19</sup>

As has been noted, the second edition of the *Magia naturalis* is, in many ways, a rewriting of recipes, experiments, and technologies that Della Porta developed elsewhere, in books published both before and after 1589.<sup>20</sup> But what did he intend to do by incorporating his own natural historical and experimental research in a book on natural magic? Since the first book of the *Magia naturalis* remains unchanged and states the principle of "magic," one reasonable way to read the whole is as a project of reformation: that Della Porta wanted to transform the

<sup>13</sup>The title is also slightly changed into *Magia naturalis libri XX*, accompanied by an explanation that claims that the author enlarged and purged from the infinite errors, and demonstrated all the riches and delights of the natural sciences.

<sup>14</sup>Orsi (2005); Borrelli (2011); Eamon (2017).

<sup>15</sup>Orsi (2005). See Della Porta's claims at the beginning of Book 8, where he states, "I intended to pass by these following Experiments in Physick, because I have everywhere mentioned them in my History of Plants; and we have not omitted any thing, that was certain and secret in them that we knew, unless it be such things as could not be brought into that rank. And though other things shall be described in my Book of Distillations, yet that this place of Physick be not left empty, I changed my opinion, and have set down some of them here." Della Porta (1658, p. 217).

<sup>16</sup>In the case of the books on optics, magnetism, statics, and distillations, which incorporate materials from Della Porta's experimental research in these fields.

<sup>17</sup>Della Porta (1658, p. 161).

<sup>18</sup>Bruyn (2001).

<sup>19</sup>Della Porta (1658, p. 395).

<sup>20</sup>Della Porta published treatises on secret codes (*De furtivis literarum notis*, 1563), agriculture (*Villae*, 1583), human physiognomy (*De humana physiognomonia*, 1586), botany (*Phytognomonia*, 1588), optics (*De refractione opticae*, 1589), pneumatic experiments (*Pneumaticorum*, 1601), distillations (*De distillatione*, 1608), and meteorology (*De aeris transmutationibus*, 1609).

natural magic tradition in such a way that it became more like natural history, or even more like experimental science.<sup>21</sup>

On the one hand, Della Porta had his own, idiosyncratic views on magic. Magic is the ultimate *Scientia*, a perfect blend of theoretical and practical knowledge. On the other hand, he claims, magic is “nothing else but the survey of the whole course of nature.”<sup>22</sup> Through the study of the heavens, stars, and the elements, their motions and changes, one can deduce the hidden secrets of living creatures, of plants, of metals, and of their generation and corruption. Della Porta is using here one of the traditional meaning of magic, which was synonymous with divination or the interpretation of natural signs.<sup>23</sup> But he does not limit the significance of natural magic to divination. He also claims that:

This art, I say is full of much vertue, of many secret mysteries; it openeth unto us the properties and qualities of hidden things, and the knowledge of the whole course of nature; and it teacheth us by the agreement and disagreement of things, either so to sunder them, or else to lay them so together by the mutual and fit applying of one thing to another, as thereby we do strange works, such as the vulgar call miracles, and such as men can neither well conceive, nor sufficiently admire.<sup>24</sup>

Magic, therefore, is founded on knowledge of the hidden interrelations between things in the natural world, sympathy or antipathy.<sup>25</sup> Furthermore, magic is able to manipulate these hidden sympathies or antipathies, bringing forth desirable effects that look miraculous to the untrained eye. The magician is ultimately someone able to produce wonderful effects through the manipulation of causes hidden to most; his natural knowledge and skilful manipulation yield marvels (*meraviglia*).

Meanwhile, for Della Porta, natural magic is intertwined with natural philosophy. It is the operative side of all our knowledge of nature. The theory of magic displays a combination of Aristotelian and Neoplatonic ontology, as every reader of the first book of the *Magia naturalis* can immediately realize. Everything is composed of matter and form. The four elements are the material principles of all things, and the four primary qualities (hot, cold, moist, and dry) are the instruments through which the forms perform changes in the world. But everything in the corruptible world is ruled by the heavens, because all things are interconnected. Della Porta is thus making use of the bonding theory (*vinculum*) that can be found in other treatises of Renaissance magic.

Meanwhile, and quite characteristically, Della Porta's magician acquires the knowledge of causes and of the relations between causes and effects through experience. This is an idea that appears already in the first book of the *Magia naturalis*, but first-hand experience is also emphasized throughout all the other books. Recipes and experiments are said to have been tried, tested, corrected, and improved to fit better into this reformed magic. If the theory of magic draws on Ficino, the recipes and experiments draw on the tradition of the “professors of secrets” and books of wonder. As has been already emphasized, Della Porta's natural magic has a theatrical element to it, and one of its main functions is to create wonder.<sup>26</sup> But then, of course, wonder is the first step towards knowledge.

What is less explicitly present in Della Porta's recipes and experiments is the astrological aspect of natural magic, which is so prominent in the first book of the *Magia naturalis*. Della Porta's practice of magic assumes an interconnected world of sympathies in which everything has its correspondent.<sup>27</sup> In this world, one can extract virtues from the heavenly bodies and infuse them in the sublunary world. But the ways in which this is supposed to work are rarely made transparent in the actual recipes of the second edition of the *Magia naturalis*, and more work certainly needs to be done to bring to light the astrological premises of many of Della Porta's experimental

<sup>21</sup>The former is the thesis defended by Laura Orsi in her PhD dissertation. See Orsi (1997; 2005). See also Rusu (2013). On the *Magis naturalis* as experimental science, see Jalobeanu (2020) and Borrelli (2020). See also Zik & Hon (2017).

<sup>22</sup>Della Porta (1658, p. 2).

<sup>23</sup>For a survey of magic in antiquity and the middle ages, see Kieckhefer (2000).

<sup>24</sup>Della Porta (1658, p. 2). On Della Porta's magic, see Balbiani (1990); Muraro (1978); Orsi (1997); Saito (2006); Vendrine (1990).

<sup>25</sup>For an overview, see Prins (2020); Rusu (in press).

<sup>26</sup>Kodera (2012; 2014); Eamon (2017).

<sup>27</sup>See Rusu (2020) for the theory of correspondences and their relation with Della Porta's experimental practices.

investigations.<sup>28</sup> Some of the later books of the *Magia naturalis* clearly bear more resemblance to collections of recipes or books of natural history than to books belonging to the natural magic tradition. Why this is so is still, we think, an open question. In fact, the second edition of the *Magia naturalis* leaves us with quite a number of open questions, as we shall see in what follows.<sup>29</sup>

Now, let us have a brief comparative look at Francis Bacon's project for a "high kind of natural magic," as it survived in the posthumous volume entitled *Sylva sylvarum*. The volume appeared in 1626 or 1627, months after Bacon's death, under the supervision of William Rawley, Bacon's chaplain and secretary. The *Sylva sylvarum* is a composite volume, containing not only the 1,000 "experiments" usually designated by this title, but also *New Atlantis*, and a list of wonders and *desiderata* entitled *Magnalia naturae*. After being neglected for centuries, this volume has begun to draw a considerable amount of attention from the scholarly community in recent decades.<sup>30</sup> One of the reasons for this renewed interest is that, although it claims to be "A natural history in ten centuries," the *Sylva Sylvarum* is strikingly different, at least at first glance, from the rest of the natural histories written by Francis Bacon. First and foremost, it is written in English, and Bacon's choices of structure and vocabulary seem to indicate that he has a different kind of audience in mind than the one envisaged for his grand-scale, Latin project of a *Historia naturalis et experimentalis*.<sup>31</sup> While the (Latin) natural histories have a relatively well-defined topic, the 1,000 items labelled "experiments" in the *Sylva* cover a vast array of topics in no particular order. Where the Latin natural histories divide the text by appeal to titles and distinguish between "history" (*historia*), major observation (*observatio maior*), advice (*monitum*), and so on, the *Sylva*'s entries have in the margins the title "experiment" (solitary or in consort), but no further specification; and this to such an extent that, at a cursory reading, one remains convinced that the *Sylva sylvarum* is nothing but a compilation of recipes taken from various sources in no particular order.<sup>32</sup>

However, a more careful reading is likely to unveil a certain amount of order in this forest of experiments. Some books do contain topical investigations, such as the investigations of sounds in Books 2 and 3, or the investigations of mixtures and processes of mixing and separation in Book 1, the investigations of plants in Books 6 and 7, and the investigation of phenomena resulting from fascination in Book 10. But the topical order is not the only one employed by Bacon. As shown recently, there is also a methodologically driven order in the serial investigations recorded in the *Sylva sylvarum*. Bacon's "experiments in consort" are very orderly investigations that display examples (or "patterns of inquisition") of Bacon's own art of experimentation.<sup>33</sup> Last but not least, some elements of order are theoretical. Many of the investigations recorded in the *Sylva sylvarum* contain rules and axioms and hence delineate the preliminary contours of new Baconian sciences: a science of vegetation, a science of sounds, a science of putrefaction and vivification.<sup>34</sup>

But why is this hybrid natural history a "high kind of natural magic"? Like Della Porta, but on a much larger scale, Bacon is also a reformer of the sciences. He wants to reform and restore all arts and sciences, including magic. However, Bacon's definition of natural magic is quite different from Della Porta's. First, for Bacon, magic is an operative science, dealing not with the "inquisition of causes" but with the "production of effects."<sup>35</sup> Furthermore, magic deals with a set of particular "effects" springing from a particular set of causes. In a peculiar manner, Bacon divides the

<sup>28</sup>The astrological aspects are sometimes more prominent in the *Villae*; and one wonders whether in transcribing some of his research in the second edition of the *Magia naturalis*, Della Porta has deliberately chosen to obscure some of these astrological aspects.

<sup>29</sup>The first edition was never translated into English, although it had been translated into Italian, French, and Dutch soon after its publication. The English translation was done rather late, in 1658. In fact, this late date suggests that the interest in Della Porta's book was still great in the second half of the 17th century, and that there was need for a vernacular edition. On the reception and impact of the English edition, see Jalobeanu (2020).

<sup>30</sup>Here is a representative sample of writings on the subject: Rees (1981); Weeks (2007); Colclough (2010); Giglioni (2010); Rusu (2013); Garber (2014); Rusu & Lüthy (2017).

<sup>31</sup>Dan Garber argued that, given all these characteristics, the *Sylva sylvarum* is a book for popularizing natural philosophy, whereas the Latin natural histories were written for the experts: Garber (2014). See also Rusu (2014) for an answer to Garber's claim.

<sup>32</sup>In their 2017 article, Rusu and Lüthy showed that there are several inconsistencies regarding the posthumous publication of the *Sylva* and that it is unclear whether Bacon wanted to publish this book, especially whether he would have published it in this form, concluding that this might have been one of Bacon's notebooks: Rusu & Lüthy (2017).

<sup>33</sup>For a discussion see Jalobeanu (2018a, 2018b, 2020). On multiple ways of ordering natural historical investigations, see Anstey & Jalobeanu (in press).

<sup>34</sup>On the science of vegetation, see Jalobeanu (2018b); Jalobeanu & Matei (2020).

<sup>35</sup>Bacon (1640, p. 143).

science of causes into a science of efficient causes, “variable and incertaine,” namely physics; and a science of formal causes, namely metaphysics, a theoretical science dealing with the *inventio* (discovery) of forms.<sup>36</sup> The two theoretical sciences have the same object, natural processes and phenomena. However, one investigates them “through narrow and restrained ways, imitating the flexious courses of ordinary Nature,” while the other reaches the higher knowledge of forms that, in turn, gives birth to magic—to the “possibility of superinducing the nature upon any variety of matter.”<sup>37</sup> Physics, learning the laws of bodies, produces an operative science that can imitate the actions of nature *simili materia*, and this is mechanics.<sup>38</sup> Understanding forms leads to the possibility of producing new bodies and processes “upon any variety of matter,” and this, Bacon claims, is the true science of magic:

... which kinde of knowledge, though in a more divine sence, Solomon elegantly describes *Non arctabuntur gressus tui, & Currrens non habebis offendiculum*; his meaning is that the waies of *sapience*, are not liable to streights, nor perplexities.<sup>39</sup>

However, it is important to emphasize that this science “which deduceth the knowledge of hidden forms to strange and wonderful effects & operations” is one of Bacon’s “deficients,” that is, one of the sciences yet to be invented. Bacon is extremely critical of what is usually called “Naturall Magique,” sharply criticizing the more traditional forms of magic:

As for the Naturall Magique, (which flies abroad in many mens books) containing certain credulous and superstitious traditions, and observations of Sympathies, and Antipathies, and of hidden and specifique proprieties, with some experiments commonly frivolous, strange, rather for the art of conveyance and disguisement, than the thing it selfe; surely he shall not much erre, who shall say, that this kind of magique, is as farre differing in truth of Nature, from such a knowledge as we require, as the Bookes of the Gestes of Arthur of Brittainne ... differs from Caesars Commentaries, in truth of story.<sup>40</sup>

If the new science of magic is merely a project for the future, and received natural magic is a sham, then, surely, *Sylva sylvarum* cannot be a book of magic, let alone a “high kind” of it. Things are never so simple where Bacon is concerned. Even if the science of magic does not yet exist, one can still work towards it, building its foundations. According to Bacon, sciences are super-structures erected on the basis of natural (and experimental) history. Starting from well-organized natural histories, one can build both the axioms of physics, leading to the discovery of material and efficient causes, and the rules of mechanics, applying this knowledge to produce effects in the world. In some of his later works, Bacon allows for parts of sciences to develop quasi-independently around particular questions that can be subjected to “exact inquiries.”<sup>41</sup> Is this method of development also available to metaphysics and magic? Can one imagine a natural history of a form leading to the axioms governing that particular form and the application of those axioms in producing *novae* in which that particular form is dominant? In *De augmentis scientiarum*, Bacon claims that one can at least try. One can begin the investigation of a form from two ends: from its simple natures and from the processes that lead to the actualization of it, combining thus, in natural historical investigations, features of physics and metaphysics. If the aim is to impose “the form of Gold” on other metals, the road to be taken should go through experimenting with “the natures of weight; yellow Collour, malleable and extensible; as also fixt and volatile,” on the one hand, and through a “search into the first seeds and menstruous Purgings of Mineralls,” on the

<sup>36</sup>Bacon (1640, pp. 144, 161).

<sup>37</sup>Bacon (1640, pp. 164, 167).

<sup>38</sup>Bacon (1640, p. 164).

<sup>39</sup>Bacon (1640, p. 164).

<sup>40</sup>Bacon (1640, p. 169).

<sup>41</sup>For a discussion, see Jalobeanu (2016b; 2018b).



other. Similarly, if one aims to achieve the prolongation of life, the investigation should be directed towards knowing “perfectly the nature of Arefaction” as well as the processes responsible for maturation and putrefaction.<sup>42</sup> These investigations figure quite prominently in the *Sylva sylvarum*, which reads, thus, as the natural historical work on which subsequent generations will build both a science of metaphysics and a science of magic.<sup>43</sup>

But there is yet another sense in which the *Sylva sylvarum* reads as a high kind of natural magic, and this is in tune with Della Porta's attempts to create and stimulate wonder through his *meraviglia*. As has been shown, Bacon's *Sylva* features recipes and experiments intended to obtain all sorts of *novae*: new kinds of plants (including plants without seeds), new animals (through spontaneous generation), new sounds, new minerals. There are inquiries that claim to perform “transmutations,” and many experiments deal with some of the most traditional forms of wonder, such as changing the colours of bird's feathers or fabricating “talking heads.”<sup>44</sup> On the other hand, most of these achievements are not pursued by means of “applied metaphysics.” As Guido Giglioni has shown, the *Sylva sylvarum* reads more like applied physics than applied metaphysics.<sup>45</sup> Many of Bacon's recipes and experiments do not recommend the imposition of (new) forms, but a good imitation of natural processes.<sup>46</sup> In a nutshell, one can find in the *Sylva sylvarum* instances of all disciplines pertaining to the study of nature: natural history, physics and mechanics, and finally (rudiments of) metaphysics and natural magic. And it is precisely this composite character that makes it even more similar to the *Magia naturalis*.

### 3 | RECIPES, EXPERIMENTS, AND THE REFORMATION OF THE “RECIPE FORMAT”

One of the most striking similarities between Della Porta's second edition of the *Magia naturalis* and Francis Bacon's *Sylva sylvarum* is the extent to which the research recorded in both is experimentally driven. As we have seen, both Bacon and Della Porta entertained plans for a reformation of magic, but they both ultimately diverged from these plans, carried away by their own investigations into the secrets of nature. This does not mean that their books do not bear the mark of a theoretical superstructure or that their observations and experiments are theory-free. On the contrary, the reader finds in both the *Magia naturalis* and the *Sylva sylvarum* an abundance of speculations, theoretical observations, causal correlations, and sometimes even axioms and rules. But this theoretical background is formulated in such a way that it helps the reader to find their way through the forest of recipes, observations, and experiments. It is used, for example, to justify why a particular recipe is placed in a particular group of experiment observations or—in Della Porta's case—in a particular book. Theoretical elements are also used to define a phenomenon or a process; they constitute the conceptual structure one has to assume in order to be able to observe and investigate a particular effect. But there is a certain open-endedness to the theoretical explanations, more prominent in the case of Bacon, but already present in some of the experiments of the *Magia naturalis*. And this open-endedness is not restricted to theoretical explanations, but extends to the recipes and experimental reports as well. This is sometimes clearly stated in the form of urging readers to further try for themselves, a clear strategy to create personal engagement and stir curiosity. But, as the papers in this special issue clearly show, there is more to this open-endedness than a mere rhetorical strategy. First and foremost, recording experiments in such a way that it leads to questions rather than to settling for an answer is something one does not usually find in collections and

<sup>42</sup>Bacon (1640, p. 170).

<sup>43</sup>On Bacon's conception of magic and its relation with the tradition, see Rossi (1968); Weeks (2007); Rusu (2013). Rusu argues that Bacon's expression “a high kind of natural magic” does refer to Della Porta, and reflects that, for Bacon, his own approach gets to the level of magic, but Della Porta's in fact remains at the inferior level of mechanics: Rusu (2017).

<sup>44</sup>See, for example, Experiment 900 on the generation of “new creatures” by putrefaction, or Experiment 200 about how to make “a puppet” or “dead body” speak. On Bacon's experiments with spontaneous generation, see Jalobeanu (2018b); Rusu (2018). On the production of plants without seeds and the transmutation of species, see Rusu (2013; 2015).

<sup>45</sup>Giglioni (2010).

<sup>46</sup>See Jalobeanu (2018b); Jalobeanu & Matei (2020).

recipes. This is why each of the following articles claim, among other things, that Bacon and Della Porta in fact depart from the recipe format, that they use and exploit creatively this traditional way of recording practical knowledge, but also go beyond it in search of new avenues for the production and recording of experimental knowledge.

Each of the four papers included in this special issue investigates quite a number of recipes and experiments recorded by Bacon and Della Porta. These investigations cover a large variety of phenomena and are undertaken with different methodologies coming from history of science, history of philosophy, and integrated HPS. With these tools, they reach quite similar preliminary conclusions, namely that Bacon and Della Porta propose, in fact, new ways of recording recipes and of reporting experimental trials. But how did they do that? And what kind of new forms and genres of research and recording did they propose?

In the first paper, entitled “Giovanni Battista Della Porta's Construction of Pneumatic Phenomena and His Use of Recipes as Heuristic Tools,” Arianna Borrelli shows that Della Porta transformed the traditional recipe format into a new strategy of research, which helped him in conceptualizing phenomena and sharing observations.<sup>47</sup> As Borrelli puts it, this new strategy does not merely concern a way of writing. It is not about recording experiments, and hence it cannot be accurately described in terms of epistemic genres. Instead, Della Porta uses recipes to devise experimental procedures, to invent new instruments, but also, and most importantly, to set the research questions in a particular field (and hence define the limits of the field itself). Borrelli works with a particular selection of Della Porta's experiments, the pneumatic experiments. She shows that the way Della Porta handles recipes, observations, and instruments to set his main research questions is strikingly modern and very similar to the way in which we talk about the production of experimental knowledge today.

Doina-Cristina Rusu's article, “Using Instruments in the Study of Animate Beings: Della Porta's and Bacon's Experiments with Plants,” investigates comparatively the ways in which Della Porta and Bacon use plants as philosophical instruments.<sup>48</sup> Rusu shows that, while Della Porta grounds the exposition of his experiments in a magical theory of correspondences and focuses mainly on “fantastical results,” Bacon treats them as tools to unveil an understanding of the fundamental processes of nature. It is on the basis of this knowledge of processes that he constructs new recipes for the prolongation of human life.

Dana Jalobeanu's article also discusses the ways in which both Bacon and Della Porta depart from the recipe format.<sup>49</sup> Her article focuses on the notion of enactment, that is, the complex set of actions and strategies one needs to perform in order to understand, try, and certify the results of a particular recipe. Jalobeanu investigates Della Porta's and Bacon's strategies of enacting the same recipes in order to show both the striking similarities and the important differences between their two projects. She claims that Della Porta transforms the recipe format, through enactment, into a new product she calls “technology.” A technology is a “stabilized” procedure of enactment, which spells out the tacit knowledge embodied in the recipe, while following its steps directed towards the production of a particular effect that is always the same. In contrast, Bacon's ways of enacting recipes lead in a very different direction, that of open-ended experimentation. Unlike Della Porta, Bacon is not interested merely in the repeatability of a particular effect. Once this effect has been established, Bacon's investigations focus on something different, on what is really at stake, namely the underlying, often invisible, processes of nature at work in the phenomenon under investigation. Thus, although both Bacon and Della Porta transform the recipe format using basically the same procedure—the enactment of recipes—they reach quite different results. The *Magia naturalis* remains largely focused on the effect of the enactment, the desired object of wonder, while the *Sylva sylvarum* moves in the direction of proper, experimental science. Both use experimentation and understand its creative and heuristic powers, but they do so for quite different purposes and, ultimately, with different results.

Cesare Pastorino's paper discusses the shape and form of Bacon's major contribution to early modern science, namely his natural and experimental history. He shows that what Bacon does, purposefully, when he assembles natural and experimental histories, is to depart from the recipe format and invent a new epistemic genre. Bacon's

<sup>47</sup>Borrelli (2020).

<sup>48</sup>Rusu (2020).

<sup>49</sup>Jalobeanu (2020).

experimental accounts are no longer descriptions of exemplary and well-established procedures. Instead, he shows a clear preference for tentative, open-ended reports. Moreover, as Pastorino shows, Bacon understands the positive value of experimental error in correcting mistakes and advancing experimental knowledge.

Overall, this special issue, through the four papers, deals with both our main aims: to emphasize the similarities and differences between Giovan Battista Della Porta's and Francis Bacon's projects of reforming natural magic, and to show that (and how), in the recording of their experimental practices, Bacon and Della Porta depart from the traditional "recipe format" and discover new avenues of experimental research. Taking this special issue as starting point, future scholarship will have to focus both on deepening the understanding we have of Della Porta and Bacon regarding recipes and experiments, and on the reception of their methods of investigating, writing, and selecting in the second half of the 17th century.

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